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ANALYSING THE ROLE OF DETERMINANTS OF 3D ANIMATION IN REVEALING THE UNKNOWN FACTS OF EXTINCT SPECIES THROUGH RECONSTRUCTION

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Abstract

3D animation is revealing unknown facts about extinct species. The reconstruction in the film uses computer graphics, to recreate the evolution of the ecosystem. The computer animation technique is a helpful medium through which the evolution of planets, earth and animal life can be described visually more refined, based on our thoughts. Through animation life on earth is created and presented to the viewers with the proper description, similarly, extinction is also described with the help of animation as a result animation has touched the sphere of our lives. It clarifies the evolution and advancement of life's survival on the earth. This paper presents a theoretical framework, analysing the role of various determinants of 3D animation in revealing unknown facts about extinct species. Confirmatory factor, Analysis, and Structure Equation Modelling are used to identify the effect of various factors of animation in the reconstruction of extinct species through path analysis. It is indicated that research & reference is the most important factor influencing the reconstruction of the extinct species, followed by designing, rigging, texturing, lighting and editing. The standard estimate of research and reference is 0.649 which is higher than other factors of 3D animation responsible for revealing the unknown facts of extinct species.

Keywords- Extinction, Evolution, Extinct Species, Ecosystem, ICT, Structural Equation Modelling, Confirmatory Factor Analysis, 3D animation, Paleontology, Paleoartists.

1.1 Introduction

From the past two decades, the learning environment has become technology based. Where animation plays a significant role in making a learning environment more effective. according to Moreno & Mager, 2002 animation is a computer-generated moving picture, which shows the association between the figure drawn. It is an effective way of pictorial representation. If we compare the animation video with normal videos, the animation seems to be more real and attractive either for entertainment or the purpose of teaching & learning animation has gained its popularity. The addition of visual form and presentation through animation is more effective than the verbal and conventional forms of representation. In school or higher academic institutions where dynamic subject matter and animated illustration is becoming more popular to address the complexity, which arises in verbal and numerical presentation (Lowe, 2004). Animation in the entertainment industry has enhanced the way of learning because the presentation through animation is useful for education and training. Animation requires effective cognitive processing demand more than static visual the reason behind, frequent change in information, related to critical objects and cognitive connection may be lost.
Due to the introduction of digital technology in the movie industry, the profiling design, movie image execution of scene and character designing are dependent upon animation. In recent years, with the rapid development and popularity of three-dimensional animation, new space is built for movie art of design. Therefore, three-dimension animation technology has gained its importance in traditional movie art design.

1.2 Application of three-dimension technology in movie designing

With the evolution of information technology, three-dimension animation is greatly promoted in the development of movies with the help of digital technology the three-dimension and movie are combined in order to make or represent the character livelier. With the help of three-dimension technology the artist conveniently represents the design plan through effective drawing with the final desired effects.
The development of the three-dimension scene model clearly shows the structure of the movies. The combination of three-dimension animation and movie art enhance the efficiency of movie designing as well as saves unnecessary expenses and wastes cost on martial. Simulating the complex scene model, single model to dynamic and display of art easily distributed through three-dimension technology. The three-dimension animation depends on virtual reality technology where the performance of the scene is an authentic and accurate example some of the animation character animation, special effects and other work act as an unprecedented visual feast. Due to the constant improvement of digitalization, the three-dimension animation technique is becoming more vivid more intrusive and immersive feeling which makes the viewing enjoyable. But the advanced display to make the character more vibrant, a perfect design scene is implemented. use of visual communication in a specific time and use of art design language creates a unique space in the audience mind. Most of the time it is found that the content of certain information has a significant impact on the physiological & ideological behaviour of the audiences.

1.3 3D Animation technology in the reconstruction of extinct species

Three-dimensional animation is the work of principal & method using a computer platform to create a three-dimensional world. The first three-dimensional visualization of extinct species from southern Alpes was presented where the three-dimensional included the live reconstruction of the extinct species was shown (Alexander, 2012). Animation of three-dimensional models of fossil specimens has gained popularity despite less accuracy. Spatial distribution orientation and size of fossils but in recent years the three-dimensional data set of extinct species is highly developed because of variable range of processing techniques and software packages. In various studies of extinct species, the application of the three-dimensional gesture model is successful. (Marchallinger, 2021; Maloo Et Al. 2010; Mary Hoper and Lukender, 2010; Kvela Et Al, 2011; Saupe et al, 2012). A wide range of analytical techniques is used in demonstrating the fossil records of the dinosaur with high variability. (Rayfield et al. 2001, 2007; Balanoff et al. 2008; Witmer and Ridgely 2009; Fortuny et al. 2011; Tsuihiji et al. 2011; Knoll et al. 2012), lizards (Polcyn et al. 2002), birds (Rowe et al. 2001; Degrange et al. 2010; Zelenitsky et al. 2011), fishes (Gai et al. 2011), mammals (Luo et al. 2002), plants (Friis et al. 2007; Scott et al. 2009). The main goal of this paper is to identify the root of various determinations in reconstructing extinct species.

1.4 3D model of fossil specimen

To study the biology of extinct animals the skeleton of these specimen must be constructed virtually by using various mean of technology. In general, the virtual model of these species is produced as prototype of the scales which allows the construction of skeleton and analysing the movement of each joint. each bone is represented virtually and assembled to form a skeleton which are the landmark of virtual skeleton. While using the prototype of bones each joint is analysed to improve the movement so that the virtual skeleton can be further modifies. The animation is repeated until the movement is perfected (Ralph et al, 2003;

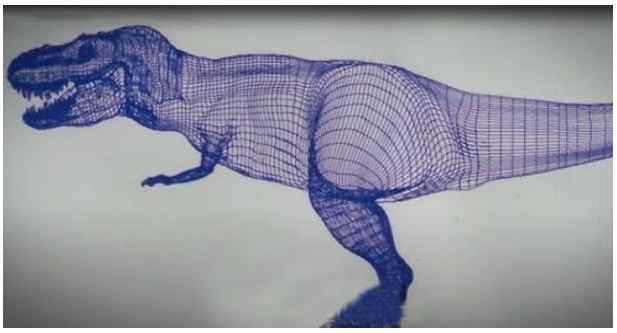

Figure 1. Wireframe Mesh

Mayrhofer and Lukeneder, 2010; Kruta et al., Marschallinger, 2001; Maloof et al., 2010; 2011, Marschallinger et al, 2011; Lukeneder and Lukeneder, 2011; Saupe et al, 2012). The phenomenon of dinosaur in Jurassic Park and succeeding sequel created finitizing truth brought forth to life. Many animals like P*arapapio* monkey, makapania, sabre-tooth cat, Mammoth and Dinosaurs etc. is extinct. These can be recreated by the help of 3D animation. The good example can be the phenomenon of the dinosaurs of Jurassic Park, a fascinating truth brought forth to life, by Steven Spielberg, and in-depth exploration of the chance, discovery and popularisation, the most awe-inspiring creatures ever to walk the earth - dinosaur. Numerous papers (e.g., Marschallinger, 2001; Maloof et al., 2010; Mayrhofer and Lukeneder, 2010; Kruta et al., 2011, Marschallinger et al., 2011; Lukeneder and Lukeneder, 2011; Saupe et al., 2012) show the many uses of 3D geometrical models in palaeontological studies. The combination of three-dimensional visualization, scanning and prototyping makes this possible for development of any animal of any size. The technology captures these data without any loss; very important for many very fragile forms and it can even help correct deformation due to the process of fossilization. Though CT scanning even allow to capture bones that are not even prepared and/or removed from their original rock matrix (Ralph et al., 2003

2. Theoretical background and development of hypothesis

Computer animation techniques which complement traditional animated scripting with autonomous agents have made possible complex life like system composed of many distributed elements (Reynolds, 1987). In task-level animation. (Zeltzer 1991), and the space-time constraints paradigm, (Witkin and Kass, 1988), these techniques allow an animator to direct a character on higher level. The idea to use the genetic algorithm (GA) for automation of animated motion follows naturally. The solution of many equations is intensively based on computationally process. Though it is complex but can be understood well and is further explained in this paper. There are some significant factors which may lead to the revealing of unknown facts about the extinct species further in this paper.

2.1. Research & References:

It is estimated that the number of extinct species could be more than 2 billion. The quantitative information can be obtained by using physical models of fossil organisms as to provide about how performance of clear activities, like gliding, varies on specific morphological features. Kingsolver (1985) used physical models based on fossil insects to measure the effects of body size, wing length, and number of wings on both aerodynamic and thermoregulatory performance. In the same way, a computer simulation of running by theropod dinosaurs that systematically varied maximal velocity of muscle contraction and mass of limb muscle revealed the parameter space in which one or the other of these factors limits running speed (Sellers and Manning 2007).

Hypothesis 1: Research & References has positive influence on reconstruction of extinct spices.

2.2. Character Design

It is essential that all the visual elements must define the personality of the character. The viewer's impression for the character is made within 7 to 12 seconds. Therefore, it becomes mandatory for the character to show its personality with vast artistic and scientific field of its appearance. To get perfect 3D character charcter desig is important technique in. Arshad, M. R., Yoon, K. H., Manaf, A. A. A., & Ghazali, M. A. M. (2019).The construction of 3D models of fossils (e.g., archosaurs) assist in visualising the interpretation and

play a role for mechanical models. The more detailed character model using 3D platform will have more impact on the views. It is an excellent communication tool for both the designer and end user show the multitude of applications of 3D geometrical models in palaeontological studies (Marschallinger, 2001; Maloof et al., 2010; Mayrhofer and Lukeneder, 2010; Kruta et al., 2011; Saupe et al., 2012).

Hypothesis 2 Character Design has positive influence on reconstruction of extinct species.

2.3. Rigging

Animating an expressive 3D character needs rigging (adding bones) to designate its internal skeletal structure, in order to specify how the input motion deforms its surface. The rigged characters are easy to animate Arshad, M. R., Yoon, K. H., Manaf, A. A. A., & Ghazali, M. A. M. (2019).
The mesh and generic skeleton in the animated character is attached to the skeleton of the character to the surface, which permits the skeletal motion dynamics to animate, and character looks to be live in return. This can be only achieved with good rigging. Ilya Baran 2007. Rigging is used to explain the process of creating the skeleton system inside the finished 3D character geometry and assigning the controller for animation to animate the 3D character. Proper setting must be planned in order to make the movement of characters smooth, so that it may look more natural. Therefore, the process of rigging of character is based on anatomy and its design (Arshad et al.,2019). Rigging system is developed for and Anthropomorphism character which is bit different from human system. Anthropomorphism character requires several modifications on their overall physical appearance, which modified Limbs, that is taken from a specific animal or any object. Therefore, in 3D animation rigging is the process of assembling the skeleton system into the character.

Hypothesis 3 Rigging has positive influence on reconstruction of extinct species.

2.4.Texturing & Colouring:

Three-dimensional modelling creation has another important stage of Texturing or Mapping. It is mainly wrapping a 2D image around a 3D object and classifying how light would affect it. “Texture mapping is a method for defining high-frequency detail, surface texture or colour information on a computer-generated graphic or 3D model, the original technique was pioneered by Edwin Catmull in 1974. This has to be clarified that the 3D model should acquire specific properties in order to construct the three -dimensional model in more realistic manner. Surface texturing quality is demarcated by the number of Texel, which is the number of pixels on one (minimal) unit of the texture. Exposing the past: surface topography and texture of paleontological and archaeological remains, Peter S Ungar and Adrian Evans, 2016. Øyvind Hammer,“Imaging fossils using reflectance transformation and interactive manipulation of virtual light sources,” 2002; Earl, Lingyun Liu, "Multiview Geometry for Texture Mapping 2D Images Onto 3D Range Data," 2006; G. Martinez, 2010; Archaeological applications of polynomial texture mapping: analysis, conservation and representation. Journal of Archaeological Science; Barber. D, 2011; S. Magnenat et al., "Live Texturing of Augmented Reality Characters from Colored Drawings," 2015. 3D Laser Scanning for Heritage (second edition).

Hypothesis 4- Texturing & Coloring has positive influence on reconstruction of extinct species.

2.5. Animation

The best way to tell a story is by 3D animations. In recent times, Disney has come up with world’s one of the most successful animation movies. They are created with the help of animation software like 3Ds Max, Autodesk Maya and other animation software. Citing an example, a study shows that animation is inspired by data for shell orientation in Cretaceous heteromorph ammonoids (Kakabadzé and Sharikadzé, 1993; Monks and Young, 1993; Kaplan, 2002). The animation is done on the existing rig (bones) system which is linked in a hierarchy with inverse kinematic constrain which allows the animators to animate it by using only the last link in the hierarchy and fixing the keyframes after different time intervals in accordance to the movement of the character. Various movements and actions are defined to create small moving story line, although this task is time taking and time-consuming process. Background surrounding is added to bring the character in an environment of its dwelling. As a case in point virtual human animation in recent time on such as (Badler 1997, Esmerado et al. 2002, Lemoine et al. 2003, and Gutierrez et al. 2004) successfully achieved high quality simulations of human motions, while little attention is given to automation in terms of language animation. Embodied interface agents (Cassell et al. 2000) that emulate lip movements, facial expressions and body poses are restricted in conversational act.

Hypothesis 5 Animation has positive influence on reconstruction of extinct species.

2.6. Sound and Music:

In the process of filmmaking, sound plays a grammatical role. It also postulates a form of continuity or connective flesh for films. The basic two attribute of sound in film, are:

a) Hyper-reality Sound recordings for film are often an exaggeration of reality,
b) Correlation with a picture Sound often has an impact on the picture. Different scenes depend on how sound plays out in them. The two basic roles of sound in the film are: storytelling and story supporting. Story telling is the major characteristic of the films. The film has dialogues, monologues or off-narration. Story supporting correlated to the sound effects that magnifies the tension in film and suggest the audience how to feel. The basic roles of sound and music in film are accomplished utilizing different types of sound in film, such as: - speech (dialogue, monologue, over voice), - music (all kind of music like recorded music, rerecorded music, , background music, live music etc.) - the sound effects hard or "cut" effects Foley sound effects (mixed with music) ambience (backgrounds) design sound effects Kenny (1999): Sound for Picture: The Art of Sound Design in Film and Television, Hal Leonard Publ. Corp. Grimshaw, M., Tan, S.-L., & Lipscomb, S. D. (2013). *Playing with sound: The role of music and sound effects in gaming.* In S.-L. Tan, A. J. Cohen, S. D. Lipscomb, & R. A. Kendall (Eds.), *The psychology of music in multimedia*. Amy Yetasook, 2021, "Creating a Harmonious Operating Room: The Role of Music and Other Sounds," review sources of disruption and discuss the potential pros and cons of music.

Hypothesis 6. Sound and Music has positive influence on reconstruction of extinct species.

2.7. Editing:

Editing is about cognitive science, philosophy and psychology. Editing helps to generate the movement, decorate the scene & dressing it in most spectacular manner. Editor respond to the movement, and that's a unique way of thinking. Karen Perlman (2009), Cutting Rhythms: Shaping the Film states how on screen drafting can be helpful for film makers. Editors shape three kinds of movement. a)They shape the movement of story. b)They shape movement of emotion, c) they shape movement of image and sound. Quentin Tarantino , Martin Scorsese & George Lucas once said "The editor writes the last draft of the script" Joseph P. Magliano, 2011. The Impact of Continuity Editing in Narrative Film on Event Segmentation studied the impact of continuity editing on how people perceive the structure of events in a narrative film and to identify brain networks that are associated with the processing of different types of continuity editing boundaries. This article considers the cognitive complexity of creative decision making in film editing.

Hypothesis 7 Editing has positive influence on reconstruction of extinct species

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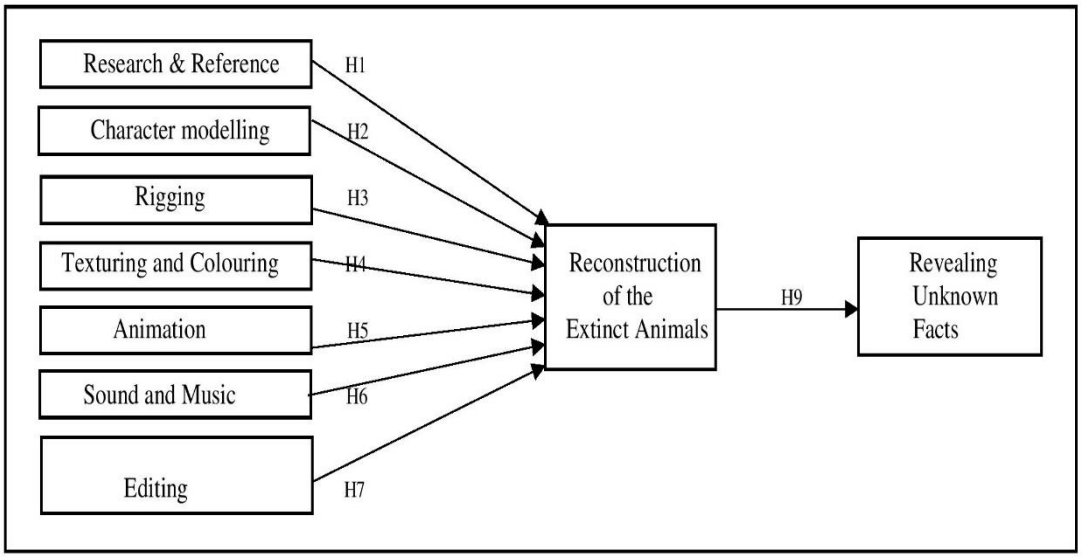


Figure. 2 Conceptual Model

3. Materials and Methods

3.1 Development, pretesting and structure of questionnaire

The questionnaire was developed to achieve the purpose, objectives and answers to the research questions. The questionnaire was developed on the basis of relevant previous studies in context of determinants/ factors "Analysing the role of determinants of 3D Animation in revealing the unknown facts of Extinct species through reconstruction", Opinions/ suggestions obtained through interviews conducted for One Hundred participants comprising of students & teachers from different school and universities and professionals from corporate and business. In-depth literature review and suggestions from participants provided guidelines to develop the questionnaire to examine the role of a wide range of determinants which influence "Analysing the role of determinants of 3D Animation in revealing the unknown facts of Extinct species through reconstruction."

Pre-testing of the questionnaire is an important step to ensure the accuracy and reliability of the questionnaire (Hunt et al., 1982; Grimm, 2010; Dimantopoulos, 1994). Prior to the consumers study to collect data in context of the determinants influencing "Analysing the role of determinants of 3D Animation in revealing the unknown facts of Extinct species through reconstruction", the designed questionnaire was pre-tested at Uttar Pradesh. The questionnaire was extensively pre-tested with one hundred respondents in order to identify and remove potential problems and to ensure its comprehensibility. The respondents comprised of students & teachers from different school and universities and professionals from corporate and business. The respondents were briefed thoroughly regarding all the sections, sub-sections and questions. The respondents were provided twenty four hours to complete the questionnaire. The respondents were asked to answer all the questions and mark confusing and problematic areas of the questionnaire. After completing the questionnaire, each respondent was asked to give their feedback regarding clarity, comprehensiveness, potential problems, ease of filling and any other issues regarding the questionnaire developed to examine "Analysing the role of determinants of 3D Animation in revealing the unknown facts of Extinct species through reconstruction". The suggestions provided by the respondents were incorporated in the final questionnaire to make it more comprehendible and easy to respond (GAO Internal Guidelines, 2017).

Table 1. Constructs of the questionnaire and their sources

Constructs	Source
General information	Chen, C., Xu, B., Yang, J. H., & Liu, M. (2022);
Research & Reference	Song, L. (2022, April);
Character modelling	Wu, H., Wen, S. J., & Yang, J. H. (2022);
Rigging	Arshad, M. R., Yoon, K. H., Manaf, A. A. A., & Ghazali, M. A. M. (2019);
Texturing	Cohen-Or, D., Mann, Y., & Fleishman, S. (1999, July);
Animation	Badler 1997, Esmerado et al. 2002, Lemoine et al. 2003;
Sound and Music	Jiang, J. 019 ;
Editing	Galvane, Q., Ronfard, R., Lino, C., & Christie, M. (2015, February);

3.2 Participants

The present study is conducted in four cities of Uttar Pradesh Lucknow, Agra, Varanasi and Prayagraj. 800 respondents were considered for the study. The participants consists of age group between 16 to 45 years. The sample has maximum number of respondents between 16 to 26 years, which is 66% of the total sample and they are students from Colleges and Universities, whereas 27 to 45 years and above are professional & job holders which is 34% of the total sample.

4 Result and Discussion

4.1 Descriptive statistics

Table 2, shows the mean score of constructs and different items of constructs i.e. Research and Reference, Character Design, Rigging, Texturing, Animation, Sound Effects, Editing and Rendering. The mean participants score indicated that convenience orientation was the most important determinant influencing the reconstruction of extinct species (Table 1). The skewness for different items of Research and Reference, Character design, Rigging, Texturing, Animation, Sound Effects and Editing values ranged from -0.918 to 0.505, which were within the threshold values of -1 to 1 (Table 1). The kurtosis for different items of Research and Reference, Character design, Rigging, Texturing, Animation, Sound Effects and Editing ranged from -1.357 to 1.933, which were within the threshold values of -2 to 2 (Table 1). The skewness and kurtosis values obtained for different items of the aforementioned constructs indicated that data/participants' liker scores were normallydistributed (Olsen et al., 2012; Rezai et al., 2014).

4.1 Measurement model

Table 3, presents factor loading, Cronbachs alpha (α), composite reliability (CR), and average variance extracted (AVE) for Research and Reference, Character design, Rigging, Texturing, Animation, Sound Effects, Editing, and Rendering. The factor loading of the different items of Research & Reference, Character design, Rigging, Texturing, Animation, Sound Effects, Editing, and Rendering ranged from 0.628 to 0.985, which exceeded the minimum cut off point of 0.60, therefore all items were included for the interpretation of the factors influencing reconstruction of extinct species. Cronbach's alpha for Research & Reference, Character design, Rigging, Texturing, Animation, Sound Effects and Editing constructs ranged from 0.731 to 0.901, which exceeded the minimum acceptable value of 0.70 (Nunnally, 1978). Composite reliability of Research & Reference, Character design, Rigging, Texturing, Animation, Sound Effects and Editing constructs varied from 0.899 to 0.990 that exceeded the recommended cut off value of 0.70 (Nunnally, 1978; Konuk, 2019). Cronbach's alpha and composite reliability values obtained for different constructs revealed good internal consistency and reliability of scale items of the questionnaire (Hair et al., 2010; Konuk, 2019). The average variance extracted (AVE) for Composite reliability of research and reference, character design, rigging, texturing, animation, sound effects and editing constructs varied from 0.538 to 0.864, which exceeded the threshold value of 0.50 (Fornell and Larcker, 1981). The factor loading higher than 0.60 and average variance extracted higher than 0.50, confirmed the convergent validity of the constructs (Fornell and Larcker, 1981; Hair et al., 2010). The square root of AVE estimates (diagonal values) was higher than the correlations estimate amongst constructs (Table 2), confirmed the discriminant validity of the constructs (Fornell and Larcker,1981; Konuk, 2019).

Table 2. Mean participants score, factor loadings, Cronbach's alpha (α), composite reliability (CR) and average variance extracted (AVE) of determinants influencing reconstruction of extinct species.

Constructs / Items	Mean	Factor loading	p-value	α	CR	AVE
Research and Reference (R&R)	3.89			0.731	0.990	0.9699
The story of the film is focused on extinct animals. (R&R 1)	3.60	0.978	***			
The fossils were well studied to design the extinct species in the film. (R&R 2)	3.51	0.923	***			
The animal (3D character) behaviour was according to the habitat shown in the film. (R&R 3)	3.98	0.729	***			
The Species of that era in the film is well designed. (R&R 4)	3.65	0.984	***			
The environment presented is well versed with the climatic condition. (R&R 5)	4.22	0.721	***			
The fictional film based on the scientific study is near to real life. (R&R 6)	4.21	0.665	***			
The Possible reason for the species extinction is well shown. (R&R 7)	4.21	0.686	***			
The film is based on facts. (R&R 8)	3.76	0.953	***			
Character Design (CD)	4.54			0.890	0.899	0.582
The extinct species created for the film is well designed after research. (CD 1)	4.67	0.712	***			

The characters developed has distinctiveness from the different species presented in the film. (CD 2)	4.94	0.880	***			
The proportion of the species is correct. (CD 3)	4.01	0.681	***			
Rigging (RIG)	4.02			0.901	0.984	0.538
The coordination of the body parts of the extinct animal shown in the film. (RIG1)	3.98	0.771	***			
The overall movement of the animated character in the film is very natural. (Rig 2)	4.06	0.774	***			
Texturing (TXR)	3.79			0.765	0.961	0.768
The look and feel of the characters in the film. (TXR 1)	3.59	0.985	***			
The skin texture of Character. (TXR 2)	3.65	0.903	***			
The animated character of Dinosaurs in its natural looks. (TXR 3)	3.56	0.873	***			
The colour tone of extinct animals. (TXR 4)	3.56	0.945	***			
Animation (ANMT)	3.22			0.892	0.961	0.629
The movements (run, walk, jump, sit) shown on the screen of extinct animals. (ANMT 1)	2.90	0.658	***			
The animal behaviour is shown on the screen. (ANMT 2)	3.31	0.829	***			
The animal (3D animated character) gestures on the screen. (ANMT 3)	3.24	0.847	***			
The animal reaction in a situation on the screen. (ANMT 4)	3.38	0.827	***			
The animal (extinct species) expression. (ANMT 5)	3.29	0.791	***			
Sound Effects (SE)	3.45			0.891	0.961	0.633
The sound of animals is effective in the movie. (SE 1)	3.31	0.827	***			
The background music of the film is effective. (SE 2)	3.46	0.853	***			
The sound of the film makes me feel that I am part of it. (SE 3)	3.71	0.774	***			
The film with a high-quality audio effect makes it alive. (SE 4)	3.30	0.759	***			
Editing (EDT)	3.54			0.898	0.973	0.600
I am satisfied with the shots of the film. (EDT 1)	2.94	0.664	***			
The transition from one scene to another. (EDT 2)	3.22	0.814	***			
The clarity to understand the sequence of different scenes in the film. (EDT 3)	3.12	0.824	***			
The duration of the shots in the film. (EDT 4)	3.32	0.794	***			
The overall pace of the film. (EDT 5)	3.52	0.789	***			
The overall picture quality of the film. (RDR 1)						
Reconstruction (RCT)	3.95			0.740	0.940	0.690
The overall reconstruction of extinct species is based on deep research. (RCT1)	3.83	0.900	***			
The overall fossils are well used to reconstruct the extinct species in the film. (RCT 2)	3.38	0.767	***			
The overall movement of extinct species is properly animated in the film. (RCT 3)	3.79	0.826	***			
The overall skin texture of extinct species looks natural. (RCT 4)	3.59	0.765	***			
The overall sound effect used for reconstructed extinct seems to be natural. (RCT 5)	3.81	0.816	***			
The overall environment presented is well versed with the climatic condition. (RCT 6)	3.36	0.912	***			
The overall 3D Animation used in reconstruction in the film is outstanding. (RCT 7)	3.67	0.741	***			

Measurement model fit indices: CFI=0.915; TLI=0.908; GFI=0.903; RMSEA=0.079; SRMR=0.054

*** Significant at $p \leq 0.01$; Skewness: - 0.918 to 0.505; Kurtosis: -1.357 to 1.933

The Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Goodness of Fit Index (GFI), Root Mean Square Error of Approximation (RMSEA) and Standardized Mean Square Residual (SRMR) were used to assess the fit of measurement model relating research and reference, character design, rigging, texturing, animation, sound effects and editing. The CFI was 0.915 (≥ 0.90); TLI was 0.908 (≥ 0.90); GFI was 0.903 (≥ 0.90); RMSEA was 0.079 (≤ 0.08) and SRMR was 0.054 (≤ 0.08), which were within the recommended threshold values (Table 2). The values of the aforementioned indices confirmed a good fit of the measurement model with data (Hu and Bentler, 1999; Konuk, 2019).

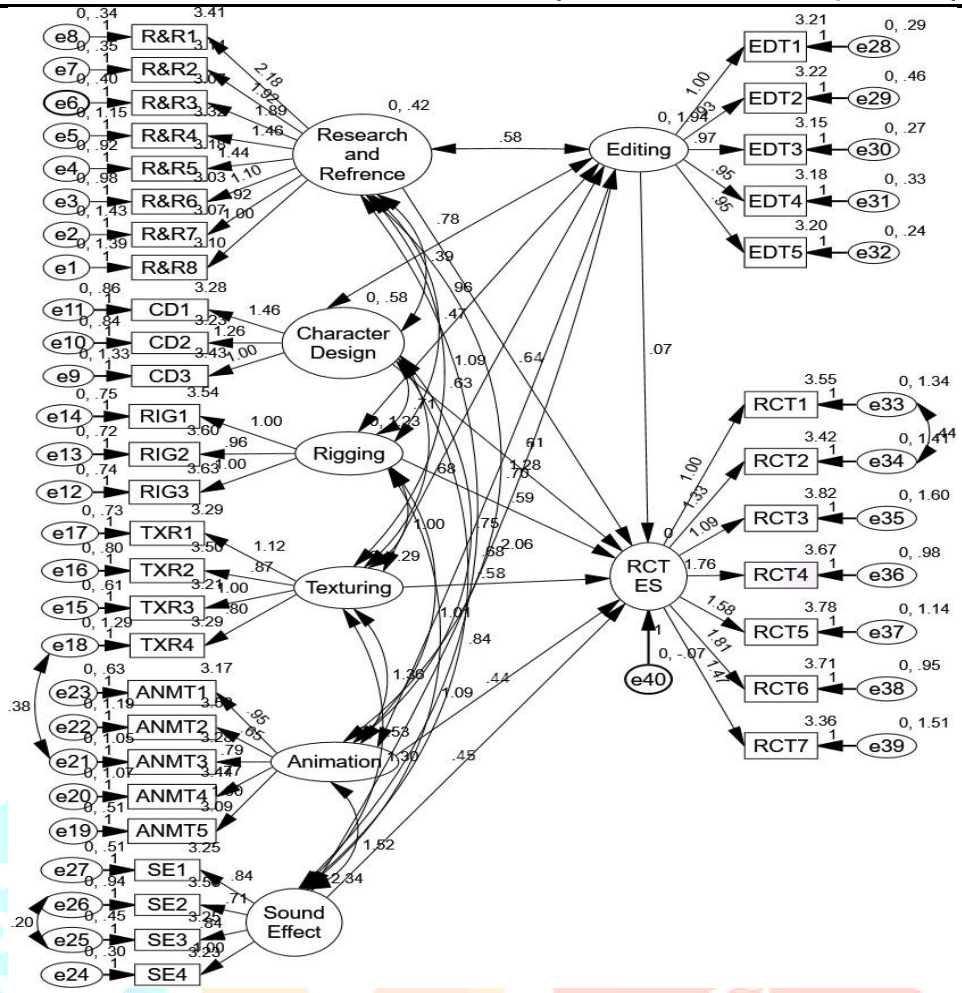
Table 3. Discriminant validity of the constructs.

Constructs	R&R	CD	RIG	TEXR	ANMT	SE	EDT
R&R	**0.984**						
CD	0.195	**0.763**					
RIG	0.146	0.273	**0.733**				
TEXR	0.413	0.172	0.101	**0.876**			
ANMT	0.195	0.545	0.273	0.172	**0.793**		
SE	0.199	0.415	0.251	0.670	0.415	**0.795**	
EDT	0.155	0.249	0.219	0.228	0.249	0.422	**0.774**

4.2 Structural model

The structural model was constructed to examine the association between research and reference, character design, rigging, texturing, animation, sound effects, editing and reconstruction of extinct species. The CFI was 0.926 (≥ 0.90); TLI was 0.908 (≥ 0.90); GFI was 0.906 (≥ 0.90); RMSEA was 0.077 (≤ 0.08); SRMR was 0.068 (≤ 0.08) and $\square^2$/df (chi square/ degree of freedom) was 3.9 (< 5.0), which falls within the recommended acceptable level (Fig. 2). The aforementioned results demonstrated good fit of the structural model (Hu and Bentler, 1999; Rezai et al., 2014; Singh and Kathuria, 2016; Konuk, 2019).

The results of structural model presented in Figure. 2 and Table 4 demonstrated the extent of association between research and reference, character design, rigging, texturing, animation, sound effects, editing and reconstruction of extinct species. Hypothesis 1 (H1), that postulated positive influence of research and reference on reconstruction of extinct species was supported as standardized estimate (ß) of the path of structural model was significant (ß = 0.649, t-value = 32.462, p ≤ 0.01). Hypothesis 2 (H2), which proposed positive influence of character design on reconstruction of extinct species was supported as standardized estimate (ß) of the path of structural model was statistically significant (ß = 0.613, t-value = 26.484, p ≤ 0.01). Hypothesis 3 (H3), which predicted that rigging has positive influence on reconstruction of extinct species was supported as standardized estimate (ß) of the path of structural model was significant (ß = 0.594, t-value = 20.984, p ≤ 0.01). Hypothesis 4 (H4) that proposed positive influence of texturing on reconstruction of extinct species was supported because standardized estimate (ß) of the path of structural model was significant (ß = 0.586, t- value = 18.863, p ≤ 0.01). Hypothesis5(H5), stated that animation would have positive influence on reconstruction of extinct was supported as the standardized estimate (ß) of the path of structural model was significant (ß = 0.445, t-value = 3.23, p ≤ 0.01). Hypothesis 6 (H6) that proposed positive influence of sound effect on reconstruction of extinct species was supported because standardized estimate (ß) of the path of structural was significant (ß =0.451, t-value = 14.787, p ≤ 0.01). The analysis of the structural model demonstrated positive influence of editing on reconstruction of extinct, supporting the Hypothesis 7 (H7), as the standardized estimate (ß) of the path of structural model was significant (ß = 0.597, t-value = 16.678, p ≤ 0.01).



Structural model fit indices: CFI= 0. 916; TLI= 0. 908; GFI= 0. 903; RMSEA= 0.079; SRMR=0.069; χ^2/df = 3.7

Figure 3. Structural equation modelling to assess the role the role of determinants of 3D Animation in revealing the unknown facts of Extinct species through reconstruction.

Discussion

Research and reference plays an important role in driving reconstruction of extinct species. The results of the structural model and mean participants score of the construct revealed that research and reference had significant and positive influence on reconstruction of extinct species. The standardized estimate of structural model indicated that research and reference was the most important factor influencing reconstruction of extinct species. Further, character design, rigging, texturing, animation, sound effects and editing are the key factors which positively influenced reconstruction of extinct species.

Table 5. Structural model results to examine the association between Research and Reference, Character design, Rigging, Texturing, Animation, Sound Effects, Editing, and Rendering with reconstruction of Extinct species

Hypothesis	Structural Path	Standardized estimate (ß)	Standard error (SE)	t-value	p - value	Results
H1	Research & Reference → Reconstruction of Extinct species	0.649	0.024	32.462	***	Supported
H2	Character design→ Reconstruction of Extinct species	0.613	0.027	26.484	***	Supported
H3	Rigging → Reconstruction of Extinct species	0.594	0.028	20.984	***	Supported
H4	Texturing→ Reconstruction of Extinct species	0.586	0.026	18.683	***	Supported
H5	Animation → Reconstruction of Extinct species	0.445	0.044	3.23	***	Supported

H6	Sound effect → Reconstruction of Extinct species	0.451	0.031	14.787	***	Supported
H7	Editing → Reconstruction of Extinct species	0.597	0.032	16.678	***	Supported

*** Significant at $p \leq 0.01$

Further, standardized estimate of the path of structural model revealed that research and reference (ß = 0.649), was the most important determinant, followed by character design (ß = 0.613), rigging (ß = 0.594), texturing (ß = 0.586), animation (ß = 0.445), sound effect (ß = 0.451) and editing (ß = 0.597) influencing reconstruction of extinct species.

5.1. Conclusion

"Recent research on Analysing the role of determinants of 3D Animation in revealing the unknown facts of Extinct species through reconstruction in the films has provided a more complete understanding of the physiological processes of the role of a determinant of 3D animation. Current findings suggest that the different determinants act together to bring output in the reconstruction of the extinct species through 3D animation film. The various determinant/ hypothesis proves to show the positive outcome. All the hypotheses are an important aspect of producing a quality film. It also reveals unknown facts by proper research & reference done in the right direction which will give Paleoartists a wide scope to design better character models. Once the good character is the design that can be rigged scientifically, adding anatomically functional bone based on research and reference to how the species could have walked on the earth once alive. This can be done based on the nearest living species contemporarily. Furthermore, the live-looking texture of the outer skin of a species can be applied to thedesigned 3D model, which will give the feel of living animal species. Animation can be added to make it more lively, this is achieved by studying the walk cycle and the physical behaviour of the nearest living creature which show some similarity even crossing the big evolution cycle. Various movements can be added after the research & reference while animating it on the screen. A sound effect is added to the 3d animation and, lastly, editing is done to get the final out to the viewer in HD format to reveal the unknown facts.

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